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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/167,247	06/23/2011	Koichi FUKASAWA	FUKASAWA=13	7616

1444 7590 04/19/2017

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ART UNIT	PAPER NUMBER
2814	

MAIL DATE	DELIVERY MODE
04/19/2017	PAPER

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE
THE PATENT TRIAL AND APPEAL BOARD

Ex parte KOICHI FUKASAWA[1]

Appeal 2015-006723
Application 13/167,247
Technology Center 2800

Before MARK NAGUMO, JAMES C. HOUSEL, and LILAN REN, *Administrative Patent Judges*.

Opinion for the Board by NAGUMO, *Administrative Patent Judge*.

HOUSEL, *Administrative Patent Judge, concurring.*

NAGUMO, *Administrative Patent Judge*.

DECISION ON APPEAL

Koichi Fukasawa ("Fukasawa") timely appeals under 35 U.S.C. § 134(a) from the Final Rejection[2] of all pending claims 1–3, 5–11, and 13. We have jurisdiction. 35 U.S.C. § 6. We reverse.

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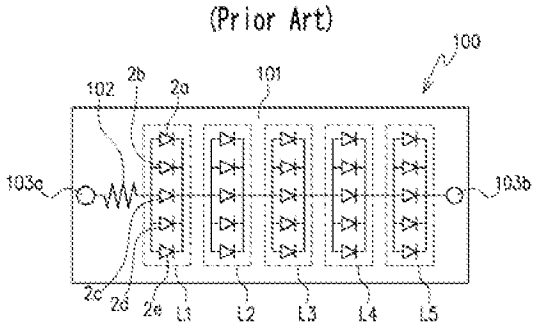
[1] The real parties in interest are identified as Citizen Electronics Co., Ltd., and Citizen Holdings Co., Ltd (Appeal Brief, filed 29 January 2015 ("Br."), 1.)

[2] Office action mailed 29 July 2014 ("Final Rejection"; cited as "FR").

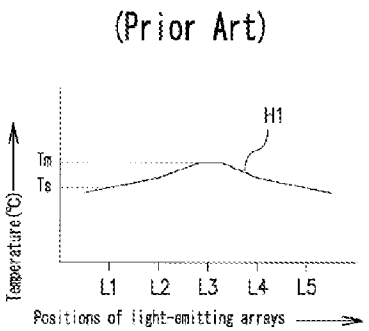
OPINION

A. Introduction[3]

The subject matter on appeal relates to high brightness light emitting devices. The devices comprise a plurality of linear packages **L**[4] of LED elements **2**. Within each package, the LED elements are provided on a substrate and connected electrically in parallel. Successive packages **L** are arranged parallel to one another, and are connected electrically in series. An example of a prior art embodiment is shown in Figure 15.



{Fig. 15: prior art lighting device **100**}



{Fig. 16: heat profile}

According to the '247 Specification, "the generally same current value flows in each LED element and generates heat in approximately the same way." (Spec. 3, ll. 16–17.) The Specification explains that diode packages **L1** and **L5**, at the ends of the array, can release heat to the surroundings. In contrast, interior diode packages **L2**, **L3**, and **L4** "tend to keep accumulated buildup temperature, which are blocked by other diode

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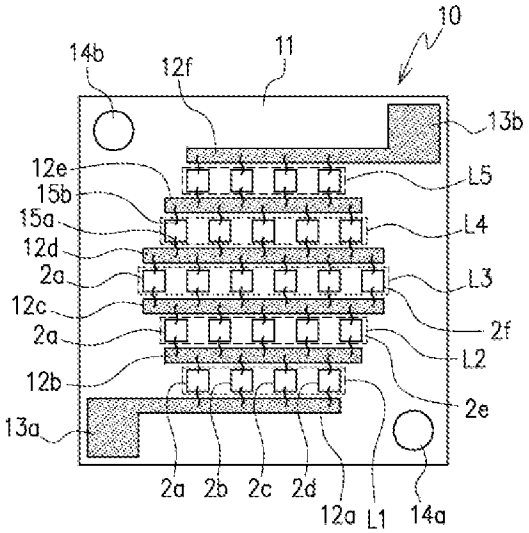
[3] Application 13/167,247, *Light-emitting device*, filed 23 June 2011, claiming the benefit of an application filed in Japan on 24 June 2010. We refer to the "'247 Specification," which we cite as "Spec."

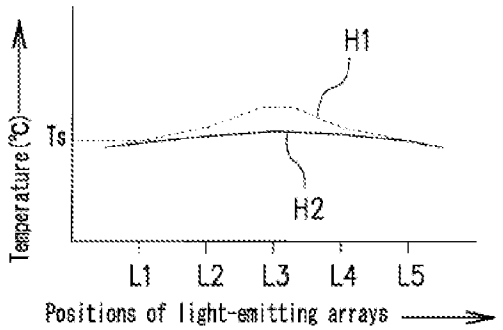
[4] Throughout this Opinion, for clarity, labels to elements are presented in bold font, regardless of their presentation in the original document.

packages **L1** and **L5**." (*Id.* at ll. 24–25.) The resulting temperature profile is shown in Fig. 16, *supra*. The higher temperatures in the middle packages are said to cause deterioration of the LED elements, resulting in changes in the color tone and shorter device life. (*Id.* at 4, ll. 16–21.)

The claimed invention is said to diminish the central heat buildup by decreasing the number of LEDs in each of the packages from the central position light-emitting package, as illustrated in Figures 2 and 3, below.



{Fig. 2 shows an inventive LED array}



{Fig. 3 shows the heat profile}

Claim 1 is representative of the dispositive issues and reads:

> A light-emitting device [**10**] comprising:
>
> a substrate [**11**];
>
> a plurality of electrode strips [**12**] arranged parallel to each other on an upper surface of the substrate;
>
> a plurality of light-emitting arrays [**L**] arranged parallel to each other, the plurality of light-emitting arrays each with a structure in that
>
> a plurality of light-emitting diode elements [**2**] are arranged in a line between an adjacent pair of the plurality of electrode strips and

electrically connected in parallel to the adjacent pair of the plurality of electrode strips by wires;

the plurality of electrode strips [**12**] and the plurality of light-emitting arrays [**L**] being arranged alternately and parallel to each other; and

at least two electrodes for external electrical connection including a first electrode [**13a**] and a second electrode [**13b**] and provided separately from each other,

the first electrode provided contiguously at, at least one end of one of two electrode strips of the plurality of electrode strips,

the second electrode provided contiguously at, at least one end of an other of the two electrode strips that are positioned at opposite ends of an alternately arranged direction where the plurality of electrode strips and the plurality of light-emitting arrays are arranged alternately and parallel to each other,

wherein the plurality of light-emitting arrays **L**, that are arranged parallel to each other include

a central-position light-emitting array **L3** that is

positioned in a center of the alternately arranged direction where the plurality of electrode strips and the plurality of light-emitting arrays are arranged alternately and parallel to each other, and wherein

*the number of the light-emitting diode elements arranged in each of the light-emitting arrays is gradually decreased from the central-position light-emitting arra*y that is positioned in the center of the alternately arranged direction toward the light-emitting arrays positioned adjacent to the two electrode strips where the electrode strips and the light-emitting arrays are arranged alternately and parallel to each other.

(Claims App., Br. 13–14; some indentation, paragraphing, bracketed labels to elements shown in Figure 2, and emphasis added.)

Remaining independent claim 10 is similar, but expresses the critical requirement as, "wherein the number of the light-emitting diode elements in the light-emitting group positioned adjacent to a center of the light-emitting array is more than the number of the light-emitting diode elements arranged in each of the light-emitting groups that are positioned adjacent to the two electrodes for external electrical connection . . . ." (*Id.* at 17, ll. 14–17.)

The Examiner maintains the following grounds of rejection[5, 6]:

A. Claims 1–3, 5, 6, 8, and 9 stand rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Konishi[7] and Yuan.[8]

A1. Claim 7 stands rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Konishi, Yuan, and Takeuchi.[9]

B. Claims 10, 11, and 13 stand rejected under 35 U.S.C. § 103(a) in view of the combined teachings of Shuy[10] and Yuan.

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[5] Examiner's Answer mailed 6 May 2015 ("Ans.").

[6] Because this application was filed before the 16 March 2013 effective date of the America Invents Act, we refer to the pre-AIA version of the statute.

[7] Masahiro Konishi et al., *Light emitting device and method for manufacturing the same*, U.S. Patent Application Publication 2008/0224608 A1 (2008).

[8] Thomas Cheng-Hsin Yuan and Bernd Keller, *LED array and method for fabricating same*, U.S. Patent Application Publication 2008/0170396 A1 (2008).

[9] Ryouichi Takeuchi et al., *Semiconductor light-emitting device*, . . . , U.S. Patent No. 6,512,248 B1 (2003).

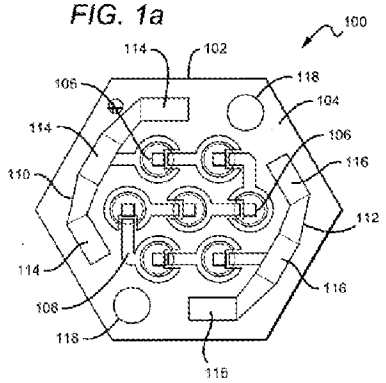
[10] Geoffrey Wen-Tai Shuy et al., *Light emitting diode matrix*, U.S. Patent Application Publication 2008/0099772 A1 (2008).

B. Discussion

Findings of fact throughout this Opinion are supported by a preponderance of the evidence of record.

The Examiner finds that Konishi (Figure 1) and Shuy (Figure 4) disclose LED arrays meeting the requirements of independent claims 1 and 10, respectively, but for the requirement that the number of diodes in the arrays decrease with distance from the central light-emitting array. (FR 2, l. 15, to 3, l. 16; and 6, l. 19, to 7, l. 11.) The Examiner finds that Yuan describes this missing limitation in Fig. 1a and in paragraph [0030]. (*Id.* at 3, ll. 16–20; 7, ll. 12–19.)

In Yuan Figure 1a, shown to the right, LED elements **106** are connected electrically in series, and are arranged in a serpentine pattern on top surface **104** of substrate **102** between electrodes input and output contact pads **114** and **116**.



{Fig. 1a shows an LED array}

Yuan, paragraph [0030], reads in full:

> The present invention is directed to compact, simple and efficient light emitting devices or arrays and methods for manufacturing same. Each array can comprise a submount with a plurality of LEDs coupled together to emit light simultaneously when an electrical signal is applied to the array. The arrays according to the present invention can include *features to provide for improved thermal management including spreading heat from the LED into the submount from where the heat can then dissipate into a heat sink attached at the bottom of device or the ambient*. This

> allows the arrays to operate under higher power and emit higher luminous flux without overheating.

(Yuan 2 [0030]; emphasis added.)

We are unable to discern any substantial evidence of a teaching in this passage that serially-connected parallel arrays of LEDs connected in parallel would be afforded improved thermal management by reducing the number of LED elements in the arrays more removed from the centrally positioned array. The only apparent teachings regarding heat dissipation relate to heat-spreading elements that conduct heat to sinks disposed on the bottom of the device.

Fukasawa points out, with commendable candor, that Yuan does mention that "[t]he light emitting elements can be connected in parallel, in series, or in a combination of both to achieve optimal light output." (Br. 8, ll. 5–7, *quoting* Yuan 3 [0045].) This teaching provides a reasonable description of the arrangement of LEDs in both Konishi, Figure 1, and Shuy, Figure 4. But it is not apparent that it teaches or suggests reducing the number of LED elements in sub-arrays more distant from the centrally-positioned array. The Examiner has not explained how the routineer would have been prompted to make the required modification.

The Examiner makes no findings regarding other teachings of the applied references that cure this fundamental defect.[11]

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[11] We are well aware of the practical difficulty of finding prior art teachings of seemingly "simple" or "obvious" modifications of seemingly "simple" inventions. But obviousness under § 103 must be based on evidence in the prior art, and a proper rejection must explain how that evidence would have taught, suggested, or motivated the modifications necessary to overcome the differences between the prior art and the claimed invention. To proceed

We, therefore reverse the appealed rejections.

C. Order

It is ORDERED that the rejection of claims 1–3, 5–11, and 13 is reversed.

REVERSED

without adequate evidence and explanation is to fall into the trap of prohibited hindsight.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte KOICHI FUKASAWA[12]

Appeal 2015-006723
Application 13/167,247
Technology Center 2800

Before MARK NAGUMO, JAMES C. HOUSEL, and LILAN REN, *Administrative Patent Judges*.

HOUSEL, *Administrative Patent Judge, concurring*

Although I concur with the majority that the Examiner has not established a prima facie case of obviousness for the claimed subject matter, I write separately to raise a matter that neither the Examiner nor the majority address. I note that the Examiner's obviousness rejection relied on modifying Konishi's LED array in view of Yuan's teaching of a three rows of 2, 3, 2 LED's and Yuan's discussion of improved thermal management in paragraph 30. Ans. 3–4. As the majority states, Yuan's discussion of improved thermal management does not relate to Yuan's selection of the number of LED's in each row as depicted in Figure 1a. Therefore, the basis on which the Examiner relies for motivating the ordinary artisan to decrease

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[12] The real parties in interest are identified as Citizen Electronics Co., Ltd., and Citizen Holdings Co., Ltd (Appeal Brief, filed 29 January 2015 ("Br."), 1.)

the number of LED's in each row from a center row or position is harmful error.

Nonetheless, Yuan does depict in Figure 1a an LED array having a plurality of rows, wherein the number of LED's arranged in each row on opposing sides of the center row have fewer (two) LED's than the center row (three LED's). Further, Yuan teaches that the LED's "can be connected in parallel, in series, or *in a combination of both* to achieve optimal light output." Yuan ¶45 (emphasis added). Appellant discloses, as prior art Figure 15, and Konishi teaches arrangements for connecting rows of LED's in an LED array using a combination of parallel and series connections. In my view, given these teachings, it would have been obvious to one of ordinary skill in the art to connect Yuan's LED's in each row in parallel and connect the rows in series as a known and predictable arrangement for connecting such LED arrays as taught in Appellant's admitted prior art and Konishi with a reasonable expectation of success.